# Assessing the Ecosystem Services of Oyster Restoration

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# Why the interest in Ecosystem Services?



- VMRC (J. Travelstead)- would like to know if places we have restored have higher ecological value as a result
- MD DNR (T. O'Connell)- need to show what benefits sanctuaries provide
- Public investment in restoration (NOAA Habitat Blueprint, etc.)

# Why measure ecosystem services for oysters?



- To provide information to managers to facilitate decision making

- To refine restoration design to optimize for ecosystem services

- To better understand the role of restored reefs in the ecosystem

- To clarify how restored reefs might count towards TMDL attainment for nitrogen

# What do we know already?



- Oyster reefs provide a number of significant ecosystem services, including:
  - Enhanced fish and invertebrate production
  - Dentrification (from sediments under the reefs)—see examples
  - Water filtration
  - Nitrogen & carbon sequestration (and removal if harvested)
  - Adjacent shallow water habitat stabilization, and *(if intertidal)* shoreline protection
- All of these services have been quantified in one or more studies, via experiments and modeling
  - However, we don't know enough yet about how these services vary within Chesapeake Bay with reef density, size, position in tributary, salinity, water flow, etc. to count these services for TMDLs, nutrient trading, or other uses

# Chesapeake Bay dentrification--recent studies



Choptank, single high density *(131 oysters/m²)*

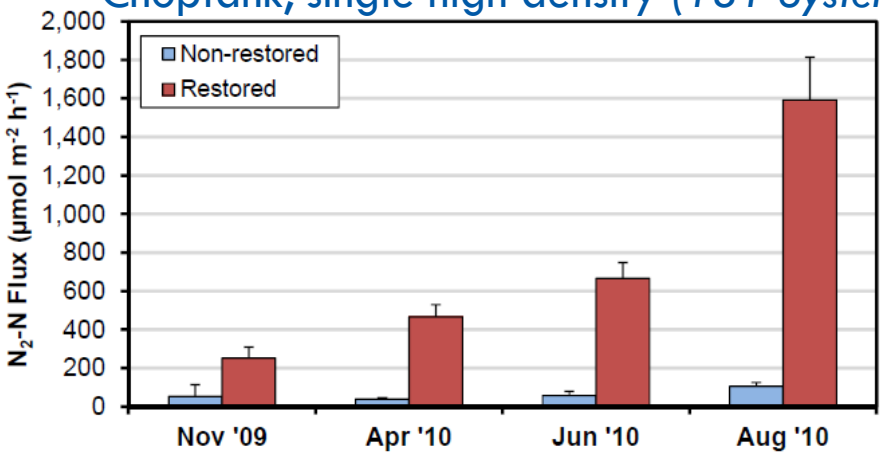



Figure 12. Seasonal fluxes of $N_2$-N (denitrification). Error bars represent one standard deviation (N = 4 except for the restored treatment in August 2010 where N=3).

Kellogg et al. (2011) showed there was a very strong seasonal component to N flux rates ***(thus, need to measure at least 4x/yr)***

Lynnhaven, range of oyster density

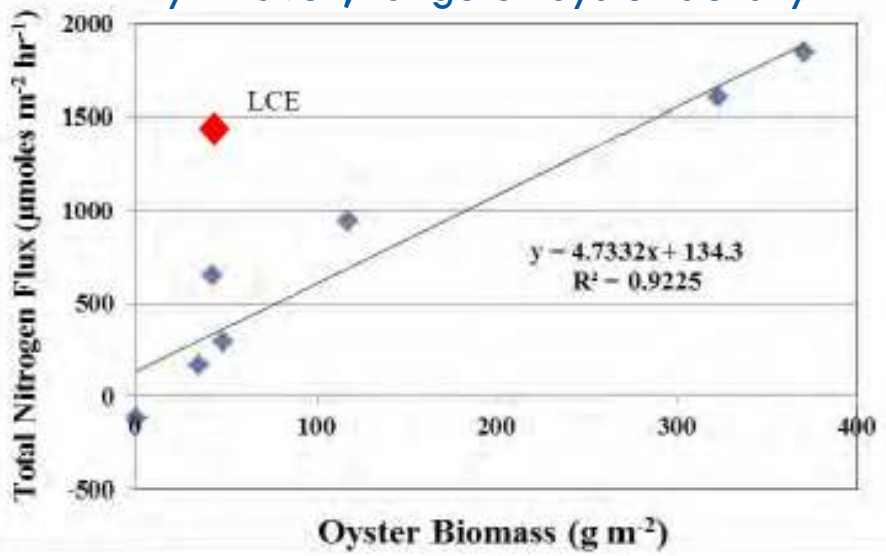



**Figure IV.1.** Total nitrogen flux as a function of oyster soft-tissue biomass at each of the field sites. Regression line is calculated excluding data from LCE.

Sisson et al. (2012) showed that annual N flux rates were usually higher where oyster soft tissue biomass was higher ***(thus, need to test a range of density)***

# How do we build on what we know?

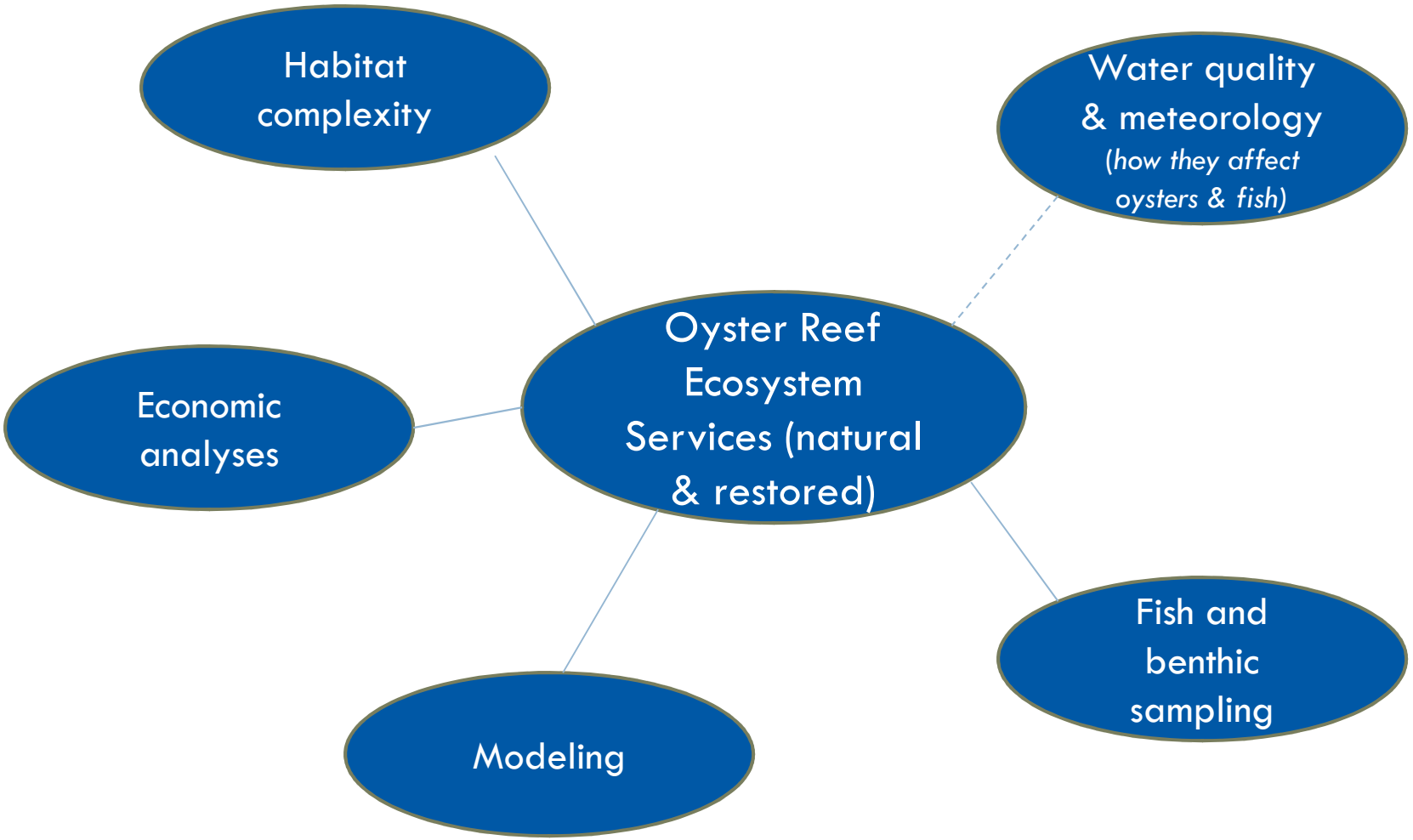


- Plan and conduct a **multi-partner study** in a tributary that is targeted for extensive oyster restoration

- Next trib to be restored in MD is **Little Choptank**; these are the proposed components of a pilot project there:
  - **Habitat complexity**: see if it is positively correlated with oyster density and biomass
  - **Water quality**: quantify its possible effects on oysters and fish
  - **Fish and benthic sampling**: see if these fauna are positively correlated with oyster density and other factors
  - **Modeling**: to use the results of other studies to estimate ecosystem benefits
  - **Economic analyses**: convert those estimated benefits into dollars

# Proposed components of Little Choptank study

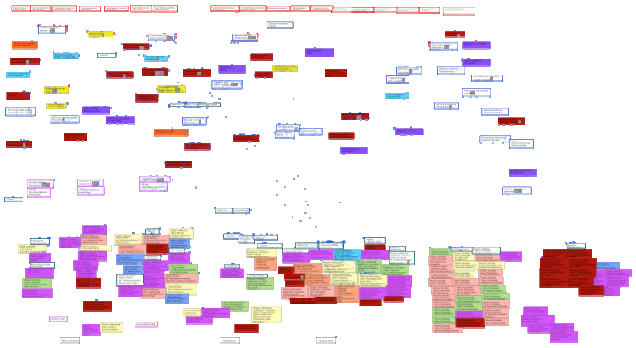




# What are we currently doing?



- Oyster Reef Model to estimate finfish production
- Workshop to estimate nitrogen removal by oysters
- Characterizing habitat before and after reef construction



| Column A. Species | Column B. Estimation if only 1/4 USACE projected Restoration Area was restored (LBS) |
|---|---|
| StripedBass | 952,397 |
| Bluefish | 3,428,134 |
| Butterfish | 262,460 |
| AtlCroaker | 61,450,967 |
| BlackDrum | 3,666 |
| OtherFlatfish | 149,957,918 |
| Weakfish | 91,577,453 |
| WhitePerch | 4,241,939 |

# How do we build on what we're doing?



- Develop a collaborative proposal for how we could better understand and value ecosystem services of oyster restoration, with a focused effort in a tributary with significant future restoration:

- Fish habitat utilization
- Habitat complexity of oyster reefs
- Water Quality
- Modeling
- Economic Analysis

# Discussion



- Does the GIT ExComm think measuring ecosystem services of oysters makes sense and why?
- Does the GIT ExComm agree a targeted and partner based concept to developing a monitoring and research design is the right approach?
- What should be our next steps?